Vol. II. No. 16. August 3, 1905.

THE JOURNAL OF PHILOSOPHY
PSYCHOLOGY AND SCIENTIFIC METHODS

THE TOTAL CONTEXT OF TRANSCENDENTALISM

I

IN my paper on "A Neglected 'Context' in 'Radical Empiricism'"[1] it was assumed with the latter that for our present philosophy, at any rate, the former dualism of 'thought' and 'thing' can no longer hold, that entities must give way to empirical relationships, or, in other terms, must be given their contextual equivalents in experience. However, it was objected that radical empiricism wrongly identifies consciousness with a special context. It was then suggested that we make the attempt to supply the experiential equivalent of the transcendentalist's position, seemingly so much at variance with an empirical philosophy.

Let us begin *ab ovo* by noting the difference between an object thought of as thing, process, or event in the outer world, and the same object thought of as experienced 'in consciousness.' To illustrate the first, the ink-stand upon my desk was for me a moment ago hardly more than a 'mere' that, yet certain things were noted as belonging to it—form, color and some of its spatial relations to other objects. This group or special context of objects, with reference to which the object of attention gets its momentary empirical character, is a system of limited but homogeneous qualities and relations, homogeneous inasmuch as all are in one context, and so, together with the thing, felt by me to exist in a physical universe. I can extend this system of relationships practically at will while preserving, nevertheless, its homogeneous character. Besides the immediate and obvious qualities of color or form I can add weight, density, capacity for absorbing or reflecting light, atomic constitution, etc. To be sure, I could not thus extend the context without passing almost immediately from the sensuously 'real' to the 'ideal,' but that is a matter of no moment here, since for us ideas and things are merely empirically distinct classes of experiences.

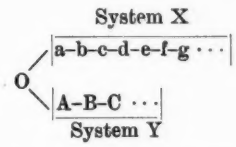
Now as long as the object continues to fit in and cohere with the contexts with reference to which it is known, consciousness and con-

[1] THE JOURNAL OF PHILOSOPHY, PSYCHOLOGY AND SCIENTIFIC METHODS, Vol. II., No. 15, p. 400.

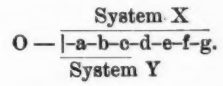
text are one, and our state is one of pure object-mindedness. If for convenience we limit the contents of the momentary experience to a very few objects, ink-stand (object of attention), weight (recognized property), percept of desk and images of earth, moon, body (context), the new item of knowledge, 'weight' is taken to be the equivalent, substitute or representative of this defining context, and the latter is the empirical 'subject' of the experience. Unless we are explicitly conscious of self as a trend of particular memories, etc.—a thing which happens more often in our social relations with our fellow men—the subject is simply *the defining context.* Now ordinarily we say that, although the object is characterized by means of these contexts, the former is 'in' or 'present to consciousness.' However, besides the object and the emphatic context there is nothing in the experience of the moment but the indefinite fringes or unused associable material. As, therefore, we are to abandon the notion of consciousness as an entity, and as it seems impossible to identify it with a special context, we must, I believe, find in the fringes the explanation. Accordingly, *the thought that this Total Context comprising the neglected experiences, constitutes a system which would be pertinent in the final definition of the object is the thought of the object as in or present to consciousness, and consciousness itself arises through the fact that there are two possible subjects or subject-contexts in any experience to which the object may be referred.* One of these is the special context which defines the object, giving to it its specific character; the other is the Total Context which defines it only as object of 'consciousness.' The Total Context with its changing content, a system to which any and every object or relation may or, as the idealist says, must be referred, is 'consciousness.' If the reference is not made, *i. e.*, if the object is not counted with the larger context, so far as the present experience goes we and the objects we think or feel are one; if the object gets presented also to the Total Context, consciousness is concerned. If the Total Context is thought of as within the span of a new system we are aware that we are conscious, that is, we are self-conscious. From this point of view consciousness and self-consciousness are essentially one, self-consciousness being merely the explicit recognition of the Total Context as a primary defining system or ultimate subject of the experience.

Let us call the latter system X, representing its contents (ill-defined objects, real or ideal, together with masses of organic sensation and feeling) by the symbols a—b—c—d—e—f—g, etc. If, further, we call the object O, and by A—B—C denote the special context (or, let us say, system Y), which is more or less within the field of attention, and by which the object acquires its definite char-

acter, the above conception of consciousness will take a form somewhat like this:



in which A—B—C are emphasized portions of system X. In this case we have a system within a system represented by



Borrowing features from Dr. Marshall's diagrams,[2] we may represent the given experience of the moment as in Fig. 1, where ● = clearly defined, and O = undefined.

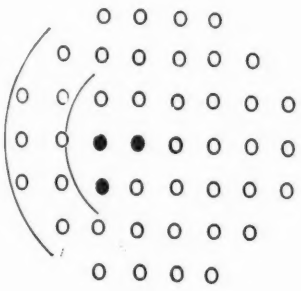


FIG. 1.

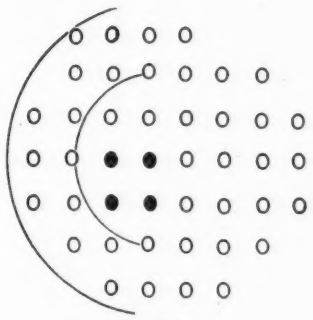


FIG. 2

In Fig. 2, a group of elements is becoming focal as an object, although it has as yet no definite character, remaining a mere 'that,' which is here represented by the arcs partially enclosing emphatic elements with their contiguous circles or associates. In proportion, however, as the object appears in consciousness as a definite thing with properties and relations, it is no longer confused with the other contents of consciousness, but is definitely a whole in contrast with the defining context, as in Fig. 3. Finally, consciousness would be a function of the relation which obtains between the object and the enclosing systems, the marginal elements outside system Y now in their turn constituting the larger system X, as in Fig. 4. The object, when counted in with system Y, acquires further specific character, which is, of course, dependent upon this context; but, if it is also counted with system X, it is 'present in consciousness,' the ultimate subject of any experience.

[2] 'The Field of Inattention—The Self,' THE JOURNAL OF PHILOSOPHY, PSYCHOLOGY AND SCIENTIFIC METHODS, Vol. I., No. 15, pp. 394 ff.

In the above diagrams the circles, which represent systemic content, should never be more than arcs of different curvature, for the reason that no one of these systems is ever complete. Not only is the Total Context never complete, but the defining context, in spite of its clearly marked systemic character, is never sharply to be distinguished from the environing contexts of marginal content, while finally the object itself is always felt to be more than it appears as mere presentation.

If now we consider for a moment the nature of conception and judgment, we shall find, I think, suggestion for the view that any definite experience in which the 'feeling of wholeness' is predomi-

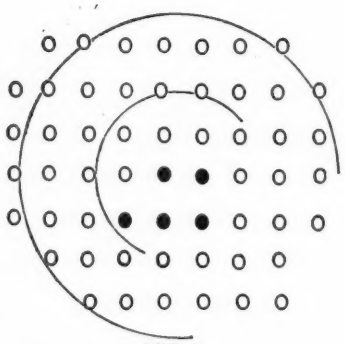


FIG. 3

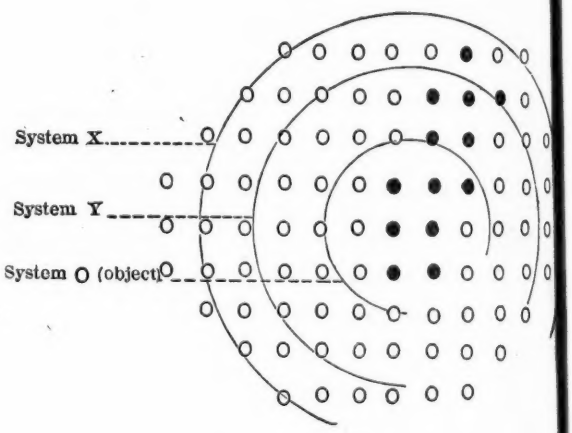


FIG. 4

nant derives this character from the fact that it is a minor representation which repeats in essential features the Total Context. The concept, which may be structurally a generalized or particular image, functionally represents groups of experiences and is, therefore, treated as substitutional. But these contexts of which the concept is functionally representative include wide tracts of undifferentiated content. Does not its dynamic power—the feeling that although we have grasped the meaning of our image and found it in some sense a whole, it nevertheless reaches forward to other relations with other content—does not this arise from the fact that it is a minor system which repeats the essential characteristics of the Total Context with its broader margins? It is the environing 'fringe' which constitutes the representative aspect of the concept, and the 'pull of the fringe' which is 'relational feeling.' In judgment also we are under the control of an ideal complex or system of which subject and predicate are momentarily regarded as aspects, and with refer-

ence to which the relation is affirmed or denied. Thus, if there is truth in the above suggestions, the foregoing processes from the ideal complex which accompanies judgment—and reasoning—to the percept itself appear as variations of the Total Complex, the variations being due to the predominance of this or that class of sensations, the extent of the marginal field included within the system, the special contexts which enter into it, etc., while the Total Context appears as the fundamental, determines the form or furnishes the 'pattern' for the minor systems.

We may now turn to some prominent characteristics of the Total Context. First, in so far as we are 'conscious' it is not simply a fringe, but in some sort a system, for it subordinates all other relations to itself; at least we think of it as making a difference to the object, all the difference there is between thing and consciousness of a thing. Second, as regards content, the Total Context does not differ from the minor systems. If the percept and images in the previous illustration served somehow to bring to mind the recognition of 'weight,' then another object, say the thought of Mars or Venus, although homogeneous with the others, since the objects are implied in a physical system of mutually attracting bodies, is, if excluded from the defining context, referred to another universe, a universe of undefined relationships which puts all the difference between the physical and the conscious. In the experience of the moment let but one element remain undefined, neglected and forgotten, it defines itself by means of a larger system, making its law known to you in your recognition that the object with its property *is*, but that you are *conscious* of it. Consciousness is the very quintessence of scepticism, for the Total Context, when you neglect it, comes back upon you with the assertion: I and I only am the genuine subject of any experience, the original and natural world order by means of which your object must ultimately be defined. Your defining context is partial and artificial; your object as characterized by it is, therefore, not the object as it is. Thus a third characteristic of the Total Context is its essentially purposive character. Particular association groups represent to a greater or less degree habitual lines of reaction with reference to the object, while purpose, as synonymous with end, is simply developed consciousness, the more than commonly persistent grasp of this Total Context in the form of defining system, while its content remains for the most part in the field of inattention.

The chief systemic characteristic of the latter is the simultaneity, the togetherness in time of its constituent objects, or, as I shall say here, their timeless unity. Since its content is made up largely of relatively persistent groups of organic sensations, its form changes

slowly when compared with particular association groups. As now we have assumed that consciousness means the presence of the object to two systems of experiences, the one a partial, the other a Total Context, and as we may further suppose that, viewed temporally, the contents of these systems have differing rates of change,[3] certain elements will always be common to both, and these elements, counted in with both systems, will constitute the felt identity and timelessness of consciousness. Thus the subject of any experience is always felt to be timeless, as subject, the object temporal and changing, while, if the former is itself made object, its contents are felt to flow.

Thus far we have been concerned with consciousness as subject or unity in experience. It is the 'I think' which Kant said must be able to accompany all my objects and to which Professor James devotes a few lines, dismissing it as the 'I breathe, which actually does accompany them.' It means simply objects, but objects in a unique relationship, which, as I believe idealism rightly claims, is the type after which we pattern all other relations. If now we abandon the entity concept and the metaphysical separation of ideal from real, terms such as 'subject,' 'transcendental ego' and the like, serve only to mark off this unique though empirical relationship from all other forms, mechanical, chemical or what not, which enter into our experience. Thus the idealist and transcendentalist lose their subjectivism. The issue is now between competing types of equally objective relationship, and the problem of idealism *versus* opposing mechanicalistic systems becomes: shall the world which we conclude to call real be interpreted in terms of system X or system Y, the one termed 'conscious,' the other 'mechanical'? Leaving this larger question as foreign to our inquiry here, we may return to the conception of the self of attention which radical empiricism identified with consciousness.

II

The Total Context and the Individual Consciousness

It is evident that the term 'my consciousness' is ambiguous, comprehending as it does two concepts which represent disparate systems of objective content, for the 'my' signifies 'biography,' 'consciousness' a function present when the object is counted with system X. My *consciousness,* as knower, or subject, is system X, a relation in and of things; *my* consciousness is 'a particular series of experiences run together by certain definite transitions,[4] memories, opin-

[3] Which does not mean necessarily that time has an independent reality. That time itself is meaningless apart from the timeless I have endeavored to show in 'An Interpretation of Some Aspects of the Self,' *Philosophical Review,* Vol. XII., No. 1.

[4] Professor James's definition of 'a mind.' This Journal, Vol. I., No. 21, p. 566.

ions, percepts, identified with a particular material organism. The two, subject and biography, are not necessarily identical. How then do they come to be identified? Why is it that instead of regarding consciousness as a type of relationship present in things, we assign to it a purely subjective function, identifying it with the conceptual self of the individual, contrasting it with spatial, mechanical and all other forms of relationship in a supposedly alien material world? It seems to me that this admits of two answers, the first ethical, the second psychological. First, in so far as the larger purposive system of the present experience is felt to be the outcome, continuation and fulfillment of incidents, plans, purposes which I have owned as part of my particular self, I as an individual and this Total Context are genuinely one. As one may step from the ground upon moving steps or upon a moving sidewalk, becoming part of a particular mechanical system, so the individual may, through the adoption of purposes, felt to be the continuation of his past self, identify himself as an individual with the present purposive context, becoming part of an objective system. In the second place, the Total Context and the 'biography' of the individual *look alike* and are, therefore, treated as one. For those objects, whether percepts or ideas, which make up the fringe of neglected content, are in all respects like those other ideal objects which form the self-group. The former, just because attention has neglected them, are vague and indefinite, and thus readily commingle with the self-group which is comprised chiefly of ideational content and is, furthermore, the most persistent of association-groups. Hence the fringe of the larger system is always vaguely felt to be a continuation of *my* self, and consciousness is mistakenly conceived to be a purely subjective form of relationship. Consequent upon this misconception is, I believe, our ordinary failure to recognize purpose as a category applicable to those groups of experiences, actual and possible, which constitute the system of external nature; but a discussion of this is obviously impossible here. In its stead, however, a word may be said in conclusion. If we may suppose that the transcendentalist had a genuine experience, and if we could interpret this in conformity with present knowledge of the structural content of entities which have had their day and are passing, Kant's Copernican change would really be the analogue of the great astronomer's physical standpoint. For it would then appear, not that objects conform to the intuitions and categories of an inscrutable inner self, but that all objects, ourselves included, conform to a type of objective relationship termed 'subject' and 'consciousness,' which we treat substantively as 'inner,'

and for practical and methodological purposes correlate with physical processes having determinate connections of their own.

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A FUNCTIONAL VIEW OF NATURE AS SEEN BY A BIOLOGIST[1]

THE following outline makes no claim to originality of treatment. It represents merely the attempt of a naturalist without philosophical training to formulate in his own vernacular certain current philosophical views in form suited to the practical requirements of his own scientific thinking. Terms are used as far as possible in the ordinary untechnical sense with no attempt to conform them to the historical usages of metaphysics. The obvious impossibility of eliminating traditional philosophical implications surely need not deter us from the attempt to do so!

We are accustomed to say that all things which constitute the materials of physical science are known to us only through their properties, *i. e.*, their behavior. It would accord more directly with experience to say that the behavior is the thing so far as known. Any substance back of the behavior is a postulate which certainly has not the merit of inductive proof. The new physics and the new chemistry (the boundary between them is breaking down) are coming to dynamic forms of statement, and Ostwald even goes so far as to affirm that the concept of the atom as brute matter is a metaphysical perversion which has exerted a most mischievous depressing influence on the progress of science. And certainly, in the organic realm, the higher we go in the scale the more clearly does function or behavior stand out as the criterion of our definitions.

That things do not exist apart from their function or behavior is a conception which possibly will not commend itself at first blush to students of physical science, though it is one of the fundamentals of biology. Our customary definition of protoplasm as living substance, for example, is a case in point. Dead protoplasm is a contradiction of terms. It ceases to be protoplasm as soon as the distinctively vital modes of function are replaced by others. This is easily recognized because the vital modes are constructive and conservative, while the inorganic modes which replace them upon the death of the organism are destructive agencies, so that a change

[1] Read before the Philosophical Club of the Ohio State University, January 16, 1905.

from one mode to the other is signalized by an obvious change in the static aspect of the thing.

But reflection shows that the same is true of any mechanism, if definitions are pushed to close limits. The function of a watch is to keep time. If it fails in this it is not a watch, though it may have most of the necessary elements of a time-piece. Obviously the mainspring is not the watch, nor is all the rest of the mechanism without the mainspring a watch. The loss of any element essential to the performance of the function of keeping time destroys its value as a watch.

Or, take a simpler illustration. I blow a soap bubble. It drifts past on the breeze, hangs glittering for an instant and bursts. As it poises before me it may be taken as a type of an object. But *what* is it? What does it mean? Its spherical form, quivering iridescence and undulating trajectory—these speak eloquently to the physicist of molar and intermolecular forces in delicate balance and of a long chain of antecedent transformations of energy. Let the balance of these activities be suddenly disturbed at any point in the system, and the object vanishes instantly.[2]

We have no experience of absolutely passive existence. All that we know can be expressed in terms of action and reaction. My brother has stated it in these words: "The energists claim . . . that substantiality is expressed by relation among activities. Activities are positive realities whenever they are shown to belong together. The bringing together is the substantiality sought, and to seek further is illogical. A relation is a real thing and expresses a law of organization. The organization is the organism" ('The Passing of Scientific Materialism,' *Monist*, January, 1905).

It is perhaps conceivable that activities might 'belong together' in perfect frictionless equilibrium. Our experience, however, gives no instance of such a perfect equilibrium; but rather of correlated action and reaction, a continuous disturbance of equilibrium with readjustment.

Our vocabulary contains no single term which designates this essential feature of things. The word *object* implies only the static

[2] James brings out very clearly ('Psychology,' Vol. II., p. 334) the relation between the so-called real essence of things and their properties in these words: "Readers brought up on Popular Science may think that the molecular structure of things is their real essence in an absolute sense, and that water is H–O–H more deeply and truly than it is a solvent of sugar or a slaker of thirst. Not a whit! It is *all* of these things with equal reality, and the only reason why *for the chemist* it is H–O–H primarily, and only secondarily the other things, is that *for his purpose of deduction and compendious definition* the H–O–H aspect of it is the more useful one to bear in mind."

or inertial aspect. *Action*, on the other hand, as generally used, ignores this aspect. But as a matter of fact all action does present, when viewed in its entirety, the element of reaction, of resistance, of stasis. We know no 'pure energy' in science, and as in the course of this discussion we use the dynamic terms, action, function, behavior, etc., they must be understood as carrying this enlarged connotation.

All finite activities, therefore, are of the nature of movement against resistance or under tension. This perfectly general statement is inductively arrived at. It is the most general formula of reality at present possible. This movement is not always of the same mode, or form of energy, and our concepts (and especially our language) are all in terms of single modes, so that the pursuit of the discussion in terms of general formulæ is difficult, if not impossible. Accordingly, we shall frame our statement in terms of one of the simpler modes (mechanics) and endeavor later to illustrate the application of this formula to other types of existence.

Every finite existence may be said to involve a polarizing of being into a focal point or center (which is not fixed, but progressively changing its character and trend) and a *relatively* more fixed field throughout which the energy involved plays (and which to this extent at least must be active). The thing existing is not the focus nor the field, but the total situation.[3]

Things are defined by the character of their manifestations of energy, and this, in turn, is determined by two factors: (1) the intrinsic form or trend of the central or focal factor (determined largely, if not wholly, by past modes) and (2) the extent and character of the field involved, *i. e.*, the nature of the resistance overcome during the movement.

In the nature of the case we can not regard either focus or field as absolutely fixed, but must go back to the ancient doctrine that all things are in a state of flux. But the fluidity is not perfect (*i. e.*, we have nothing in nature corresponding to the metaphysical doctrine of pure being), and the sphere of resistance which any concrete activity meets is its 'field.' From the point of view of this thing the field is relatively fixed, though it may be as labile as you choose when viewed otherwise. So the 'focus' of this activity may lie in the 'field' of some other. The figure, of course, is very gross and must not be pushed far. Perhaps the meaning will come out more clearly in the application to the higher types of beings.

[3] Nor is it the realizing in my consciousness of the situation. The thing, in one of its aspects, is the modality of energy, and, from another point of view, may be the *form* of experience. Or, more explicitly stated, we take our departure in this inquiry from a realistic standpoint as contrasted with that of subjective idealism.

The situation as thus defined may be looked at in various ways, of which two require more special treatment. (1) It may be viewed in longitudinal section, *i. e.,* as taking place in time. Here the running sequence, the fluidity, brings into strong relief the dynamic elements, and we see the process as *function.* (2) It may be viewed in cross section, *i. e.,* as extended in space. Eliminating the temporal factor, as in an instantaneous photograph, the static elements more clearly appear and we term it an *object,* a *structure.*

It must be noted that the thing under consideration is neither the structure nor the function, though it is both. This distinction does not exist in reality; it is artificially produced in our attempt at analysis. But the artifact is a necessity by reason of the limitations of thought and of language.

It may be objected by the philosophers that in such a methodological analysis of experience as we are here attempting the concepts of time and space are out of place. This may be true, and it is freely admitted that the figures of the longitudinal and cross sections must not be treated as ultimate conceptions. But these concepts of time and space are very useful as tools of scientific research and it must be left to the philosophically inclined to formulate the distinction between function and structure in more general terms. This has been attempted from various dynamic points of view. Thus we have Bawden's expression, 'The function is the meaning of the structure'; Dewey's logical formula, 'Judgment is the direct reference of meaning to existence (predicate to subject): inference is the indirect reference'; and C. L. Herrick's, 'Existence is the affirmation of attribute.' All of which carry us rather too far afield to serve our present purpose.

Our figure suffers from the more obvious defect that any *section,* even the 'longitudinal section of a process,' is necessarily static, so that to bring out the meaning the term must be loosely used for a view of the movement *as movement.* Now, scientific explanation is the putting of things into relation, and the bonds of relationship come out more clearly and in richer detail when attention is fixed on the dynamic phases of the thing than when we look at its structure. But these dynamic phases are often too intricate and evanescent for our imperfect senses to take in. So to bring out clearly the difference between a pacer and a trotter we compare two series of instantaneous photographs of the movements. These, however, can never give us the full explanation until we translate them back into movement either by means of the vitascope or in imagination.

Or, again, the success of the histologist who studies serial sections of the brain of a fish will be measured directly by his ability, not only to carry in mind his enlarged reproduction of the *structure* in

the three dimensions of space, but especially to vivify that reconstructed mechanism by functional interpretation. If he stops with the construction of a wax model, he may create a fine work of art, but as a *scientific* product it is worthless until he goes on to discover what each part is *for, i. e.,* what it does.

Beings may be ranked in a graded series (which may correspond approximately with the order of their appearance in time, on a theory of progressive cosmic evolution) on the basis of the form and the elaborateness of the energic complex, their range or the extent of the 'field,' and the definiteness of the polarization of focus from field. Thus a dynamo is a higher type of being than a tuning-fork.

Living beings are exceedingly elaborate complexes in which one of the distinguishing features is the high degree of differentiation of intrinsic and extrinsic factors, of 'focus' and 'field.' The intrinsic factors are illustrated by heredity and all the distinctively vital functions; the extrinsic factors are collectively termed environment (including the internal environment, as well as the external environment). It seems probable that at or near the focal point of the system lies metabolism of proteid. The organism is the interacting system as a whole, *i. e.,* the sum total of the reaction of protoplasm and environment, and may be studied from without, either as static (anatomy) or as function (physiology). In fact, the term *function* was first applied in this sphere, and the current specialization of physiology apart from anatomy is an expression of the importance of this analysis.

We recognize at once the solidarity of inorganic bodies with their environment. All inanimate nature is closely articulated in the perfection of mechanical adjustment. With living bodies the same intimate relation with environment prevails, as suggested by the Spencerian formula, 'Life is the continuous adjustment of internal relations to external relations.' But *in addition* there is a more perfect autonomy which is better brought out in my brother's definition of life, 'The correlation of physical forces *for the conservation of the individual.*' The emphasis here upon the persistence of individuality during change signalizes the distinctive feature of living bodies, and brings out sharply the contrast between focal (individual) and marginal (environmental) peculiarities to which reference was made above.

Man as organism may, of course, be studied in this way. But *my own* being stands opposed to all others in that there is self-consciousness. This, of course, is unanalyzable and inexplicable. But (and this is the essence of the 'functional' philosophy) it is not a thing apart, incapable of correlation with other parts of nature. It, too, is process, and when studied as such is found to have much in

common with the dynamic process or function as we find it in the objective study of other things than our own experience.

We have the evidence directly in experience that the conscious process is a movement against resistance, is tensional. A passive experience is an impossibility. We say, 'the mind goes out' actively to every presentation of sense, and the higher types of mentality exhibit tension and the overcoming of resistance at every step. At present, therefore, there is a tendency to regard the doubt, the question, as the typical psychic mode. When the question is answered and the resistance overcome this psychic process comes to an end; we stop thinking about it, though it may immediately become a datum for a new train of thought. Or, if apperception be chosen as the typical psychic mode, it amounts to much the same thing. A mere sensation is meaningless until assimilated to past experience. Until so assimilated it represents merely a break in the continuity of experience. This is unnatural and distressing; hence tension and effort to effect the synthesis. Apperception is the active building of the new element into the previously framed structure, and the questioning process continues until it fits into its place. We have at the end cognition of an *object,* the object as known representing the static phase of the dynamic process which we term cognition.

In this and many other ways which might be cited, consciousness as given directly in experience can be compared with the dynamic aspect or *function* of the other realities of our world. But my conscious life may also be studied critically in retrospect in a scientific way, and the consciousness of other men and lower animals may also be studied through the medium of language and other physical manifestations. And, when thus studied scientifically, consciousness is found to bear all the marks of a physiological function. Viewed physiologically, the relation between brain and mind is similar to that between the dynamo and the electric current which it 'generates.' Either is meaningless—indeed, not really existent, as we saw at the beginning—without the other.

In the case of brain, electric generator and soap bubble, to recur to our first illustration, we have a dynamic complex which polarizes into focus and field. Looked at as static and in terms of space relations, we have structure (bubble, machine, brain). Looked at as process and in terms of temporal sequence, we have function.

To an outside observer the relation of structure and function is essentially similar in all of the cases cited. The activity of any brain other than my own (and of my own in some of its processes) I recognize as a function strictly comparable with that of any other organ. My neighbor and my neighbor's dog are both to me bundles of structures and functions. But in my own case I have come to

recognize, by the indirect route suggested above, the fact that certain of the modes of the activity of my brain (or rather of my whole organism and the environing field related thereto, to be more accurate) constitute my consciousness.

We have seen that progressive polarization, and consequent individuation, is one of the characteristics of advancing rank in the orders of being. This involves, also, a sharper differentiation in our analysis of structure and function. In the organic realm, as distinguished from the inorganic, this differentiation comes out most clearly; and in the mental, as distinguished from physical or physiological function, the process has been carried so far that mental function as such, *i. e.*, as self-consciousness, while conscious of itself as function and of the analysis of structure and function in the elements of its own field, is not directly conscious of the field of its own activity as one with that activity. Indeed, in the nature of the case it can not be. For, while any element of that field, an 'object of sense,' may be, indeed must be by a reflective mind, analyzed into structure and function, both of which are objective to the observer and whose separation by other than logical analysis is obviously impossible, yet the total energic complex which constitutes my life can not be so analyzed except by one on the outside. If my consciousness is the dynamic aspect or function of that complex, it can not at the same time be the static aspect or the structure. That is, my consciousness can not be the function of a structure and at the same time know that structure as structure.

Thus the subjective comes to be sharply set off from the objective in my experience. This sharp opposition is simply a further elaboration of the individuation of intrinsic factors which we saw above to be a distinctive characteristic of all living beings.

Objection may be raised to this form of statement as a characterization of consciousness as a function which has somehow lost its structure, while our main contention all the way through has been that these two are inseparable. But I insist that it is the exact converse. To the naïve man his own mental life is simply function—nothing more. The ancients located the mental faculties in the heart, bowels, etc., and sometimes regarded the brain as a mere temperature regulator on account of its bloodless and inert appearance after death. By prolonged scientific research we have discovered that the brain is in a true sense the 'organ of mind.' But this does not alter the fact that my own conscious process gives me no *direct* knowledge of cerebral structure, nor of any other structure. Directly, I seem to experience a 'stream of thought' or flow of mental process. But I have learned, as philosopher, to see that this is an incomplete and so incorrect view of the case and that my body is

the thinking organ. And so we have *found* a structure for that which at first appeared pure function. Furthermore, we have also now found the philosophical unity underlying that which we all experience as duality—the subject and the object—and now we see why it requires both of these factors to constitute the real self, as James teaches in his spicy chapter on the Consciousness of Self.[4]

This polarization of the self with the function of consciousness at the nodal point is doubtless the reason why we find that a functional point of view gives us a more illuminating insight into nature than does a structural view-point, even though we find at the end of our inquiry that from neither position alone can we get a complete view of reality.

It may not be amiss to emphasize again at this point that that which I call myself, like everything else, is neither structure nor function, neither body nor mind. It is the total situation, the functioning structure, action and reaction in a resisting field. From *my* point of view the field comprises the objects of experience and the focus of the action is my conscious process. To an outsider, however, I am merely one element of his field, an object, which he may view either as structure (my body) or as function (my behavior).

If, then, the total vital equilibrium, including as one of its elements the body-mind interaction, constitutes myself, but I can have *direct* experience of only a portion of one member of the system (*i. e.*, of those functions only which we term conscious), how can I truly follow the ancient injunction, 'know thyself'?

We are taught that scientific introspection is an impossibility, when strictly conceived. We can not fix states of consciousness in order to give them critical study. We can only grasp at them as they flit by and then study their vestiges in memory. In this process the dynamic element is lost. They become static, as truly objects of study as brain cells or chemical reactions. Accordingly, the current psychology of the day is mainly of the type called structural psychology and it is only with great difficulty that this can be translated into terms of genetic, dynamic or functional psychology—and that, apparently, only under the influence of pressure from without, from philosophy, biology, etc. These mental elements, when thus

[4] The error of subjective idealism lies in just this failure to recognize a real structural element in things. We may admit, without laying ourselves open to this reproach, that I know *directly* only the mental (functional) member of the dynamic complex which constitutes myself, *i. e.*, of certain interactions between my hereditary and other endowments ('focus'—the 'I' of James) and my environment (the 'field,' which includes the 'me' of James). For I have excellent inductive evidence of the reality of the objective elements of my own direct experience, as well as of other types of interactions than my experience.

objectified and studied in all of their relations, physiological as well as psychological, are found, as we have seen, to belong in the category of *function*. And now that the recasting of psychology in functional terms is well under way, we are led by this indirect route to the belief that conscious process, as I experience it directly in my own life, is function, even though the corresponding structure in the nature of the case can be known as a whole only indirectly. On the other hand, the dualism of my experience does not reach to an outsider. My mind and my body to him constitute one person in whom structure and function (if the observer were sufficiently master of anatomy, physiology and the cognate sciences), though sharply separated in logical analysis, could be fitted accurately together, mutually ' explaining' each other.

Are we then led back to the position of the old materialists, that thought is produced by the brain as bile is produced by the liver? To this one can give a categorical negative. Thought is not *produced* by the brain, nor is any other function produced by its structure, for that is to imply that the structure can in some way precede its function, the impossibility of which is manifest when we consider that structure can be defined only in terms of function. We students of natural science are apt to conceive of structure as something fundamental and primitive to which functions may in some way be added as a sort of accidental 'property.' Nothing could be more unscientific. And the functional view differs from materialism in that it sharply recognizes this fact, insisting that function in general, and mental function in particular, is in no sense to be conceived as subsidiary to, caused by, or derived from structure.

The philosophical questions as to the nature of ultimate existence do not necessarily enter in this discussion, but we may add a word or two. The functional philosopher may share with the idealists the belief that all things in your world and mine have grown up in our direct experiences. This experience is primary and is our ultimate court of appeal. All our world of objects (including immaterial objects such as ideas and hypothetical objects such as atoms and imponderable ether) is a 'construct.' But this world is real (however imperfect may be our realization of it) and serves as the 'field' in which those activities play, the mode of certain of whose tensional phases constitutes my consciousness.

Throughout the preceding argument we have spoken of all finite existences as polarized and as manifesting a duality, which culminates in the dualism of experience as recognized in philosophy. But it must be emphasized again and again that this is a purely methodological analysis, necessary perhaps only by reason of the limitations of thought. The existence itself is *one* thing, and our

analytical procedure must not for an instant be used as a justification for an ultimate dualism in nature. Nor, on the other hand, can we take a monistic position on either one of these methodological foundations alone. One can not be a materialist without giving the structural aspect of our analysis precedence over the functional; nor can one be a pure idealist from this point of view without giving the functional aspect precedence over the structural. But either of these procedures destroys the existence of the thing; for the structure can exist and be defined only in terms of function, and function can not exist dissociated from structure. This applies to everything from the chemical element to the human self. The methodological analysis can have significance only when things are viewed from the outside. In the case of the conscious person the clear analysis into the body and mind appears to have come rather late in human history. And from early Greek philosophy to the present time there has been profitless debate as to which of the artifacts thus produced is the real self. The philosopher, in reeffecting their synthesis, does not return to the uncritical attitude of the child to whom the world is 'a big blooming, buzzing confusion'; but he builds up a world of *correlated* reality which is made possible only by reason of the analysis and synthesis in detail of the successive concrete data of daily life.

Again, to conceive the ultimate being as spontaneous energy may be permissible, but the expression is apt to carry the implication that the energy is 'disembodied,' or free from any structural element. This is not justifiable; for if the structure is simply a static aspect or phase in methodological analysis, it is clear that any equilibrated system of energy must exhibit a structural aspect, if subjected to such an analysis as we have attempted above. As a matter of fact, the feature already noted, that we must polarize these elements in order to discuss them, carries the implication that the concepts should be recast. Let us hope that some time they may be passed into solution and recrystallized in a more practicable form than is at present available. To use Professor Bawden's expression, 'The concepts of structure and function, matter and mind, thing and meaning, must be recast in terms of each other.'

At the conclusion of this argument the question naturally arises, What have we gained? Is not the problem of the meaning of the relation between function and structure as great and as far from solution as the philosophical question of the relation between mind and matter in its original forms? Granted. But, note that we have now one problem, not two, and this is the aim of all scientific investigation, to effect such correlations as will reduce the number of unknown factors. The law of uniformitarianism is the greatest induc-

tion of modern science, and the present inquiry is an endeavor to bridge one of the many gaps in the continuity of knowledge that still bar our progress. If mind can be subsumed under the general term function, we are the gainers by just that correlation. We have made one further step in the integration of knowledge. The advantages which follow to philosophy from the taking of this step are being rapidly elaborated in the recent writings of the apostles of the functional school.

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REVIEWS AND ABSTRACTS OF LITERATURE

Species and Varieties, Their Origin by Mutation. Lectures delivered at the University of California by Hugo de Vries. Edited by D. T. MACDOUGAL. Chicago, Open Court Publishing Co. 1905. Pp. xviii + 847.

Since the completion, not more than two years ago, of Professor de Vries's '*Mutationstheorie*,' the appreciation of the importance of his contribution to the theories of the origin of new forms has been rapidly growing. During the summer of 1904, on invitation from the University of California, Professor de Vries delivered a series of lectures at Berkeley which, under the editorship of Dr. D. T. MacDougal, are presented in the volume before us.

The key-note of the whole book is struck in the last of the three statements, printed on one of the fly-leaves. These statements, which make a somewhat dramatic opening to the whole discussion, are as follows: 'The origin of species is a natural phenomenon,' Lamarck; 'The origin of species is an object of inquiry,' Darwin; 'The origin of species is an object of experimental investigation,' de Vries. It is in this matter of experimental investigation, perhaps, that Professor de Vries has made the most important advance and has reawakened the active interest which, despite many able workers and theorizers, had flagged since the time of Darwin. To have brought the question within the field of experimentation has brought, too, the hope that some more definite evidence can be obtained as to the mechanism of the origin of new forms. To Professor de Vries's keen reasoning, his acute observation and above all his accuracy and care of culture methods, is due the new light that he has been able to throw on this most perplexing of all problems. To maintain that his theory is complete in all respects would, of course, be the attitude of an incautious enthusiast, but at least this much can be said, the author has seen and has recorded the springing into existence of new forms of plants of sufficient difference and stability to be regarded as what we are pleased to call new species.

In discussing the origin of these new forms it is necessary to distinguish carefully what is ordinarily meant by a *species* and what should be

understood by the term *variety*. This is accomplished in the chapters which lead up to the discussion of the mutation theory itself; and, while a considerable portion of the book is so occupied, the outlay of space is fully justified; for, without this, confusion would only be worse confounded.

It is first to be understood that the Linnæan or collective species are not in reality founded on single types, but rather on groups of closely similar types, and that the concept of the species as a whole is, so to say, the average impression. The forms which make up these group species are termed by de Vries *elementary species,* which differ from one another along positive rather than negative lines, and differ also in more than one quality. These elementary species may, indeed, constitute subspecies or the new species which the later, more critical taxonomists have segregated from the older group species. The existence of less fundamentally differing forms must also be recognized, and these, in the sense hereinafter stated, are the *varieties* of de Vries. These varieties differ from the type from which they have sprung in a usually retrograde direction, by the loss of some one unit character or, in rarer cases, by the reappearance of some character possessed by nearly related forms. Varieties, then, differ usually by but one character and contain no elements really new. The term as ordinarily used is, however, a somewhat loose one and no doubt includes forms which should really be relegated to the class of elementary species.

The next question considered is the behavior both of these elementary species and of these varieties in relation to their progeny. Excluding all cases of hybridism and what are afterwards termed 'ever-sporting varieties,' the cases of atavism among varieties are found to be rare. Certain well-known atavistic forms of plants are, indeed, widespread in a geographical sense, but this is due to various means of vegetative propagation and not to the recurrence of the atavisms. Including, however, the cases where hybridism may have played a part, false atavism, or '*vicinism,*' is frequently observed and is to be ascribed to the accidental and often undetected production of reversionary hybrids, and can not be attributed to any innate tendency within the organism itself.

This leads to the discussion of hybridism in general, and again the author accentuates the difference in the behavior of species and of varieties. In the case of the former the unit characters which go to make up the difference between two species do not find their mates when the forms are crossed; the qualities are impaired, and consequently the crosses may be called uni-sexual. The resulting progeny are stable, non-reverting hybrids. In crossing varieties, on the other hand, the unit characters are all present and combine in pairs and the crosses may consequently be termed bi-sexual. The resulting progeny are not stable and will in due course revert according to the principle established by Mendel. According as to whether given unit characters are active or latent one or another quality will be respectively dominant or recessive.

Having shown that atavism among varieties is of rare occurrence where the question is not complicated by hybridization, the author next

considers the question of the '*ever-sporting varieties.*' By this term he means varieties of pure origin which show a tendency to sport in nearly every generation. The somewhat cumbrous term is necessitated by the loose use of the word 'sport,' as it is commonly employed by horticulturists. Numerous specific examples are treated, and a careful analysis of this 'ever-sporting' tendency is made. It appears that the phenomenon is pretty definitely limited between two extremes. As the author puts it, it is to be regarded as a mere swinging from one extreme to the other of two opposite types, which happen to be united in one race, and that the limits of the 'ever-sporting variety' are as sharply defined as in any other variety. Thus again we can not find even in this process anything which will lead to the production of really new forms.

Thus does Professor de Vries lead up to the climax, namely, the production of *mutants.* These *mutants* are new, elementary species which have arisen suddenly and without intermediate steps from the parent type, and which, when properly guarded, breed true to their new characters. To grasp the full meaning of this it is necessary to follow the line of the author's thought in detail. It is impossible here to explain how he was led to seek for forms which evinced this tendency towards the sudden appearance, not of mere varieties, but of these new elementary types, which show some positive variation from the parental form.

As is well known, Professor de Vries found in *Œnothera lamarckiana* a plant most favorable for observation, although his conclusions are not based alone on the evidence afforded by this example. In all he obtained a dozen new types, all from the original parent form, *Œnothera lamarckiana,* although some were no more than varieties. Especial attention should be called to the fact that these pedigree cultures were carried on with the greatest care to insure the purity of the offspring and to keep an unimpeachable record of the pedigree of all the plants. The author makes it plain that such precautions are a *sine qua non* for results which are to have any value; and in the light of the possibility of hasty and incorrect conclusions being drawn from less accurate work, it is of the first importance to reiterate this.

Of these mutants which have been seen to arise some are, then, evidently new species. Their line of departure from the parent type may be in almost any direction. Some, we may say, are probably destined to failure, others perhaps are better placed than the parental type and could, in time, conceivably stamp it out. Here it is that we can apply the Darwinian idea of the struggle for existence, a struggle, however, not between single individuals, but between whole groups of elementary species. By such means, as Professor de Vries maintains, the process of the evolution of new forms might take place with far greater rapidity than by the method implied in the idea of continuous variation. Whether, indeed, origin by mutation is the only way in which new species may come into being is, of course, an open question, but that they may and do arise by these sudden jumps there seems no doubt after a consideration of Professor de Vries's evidence.

Such are, in the main, the important facts presented in the book. A

discussion of a general hypothesis of mutation must be in a measure speculative. One asks, what are the predisposing causes which lead to a state of mutability? Is there any periodicity in mutation periods? In fact, a host of questions, to which as yet no answer can be given, are at once suggested. It is plain that it is on the physiological side that the author expects to get the most assistance. Indeed, it is in the accentuation of the physiological as against the purely morphological point of view that he has done the greatest service towards the encouragement of research. If we are to find the stimulus which influences organic forms to mutate, if we are possibly to control the process in any way, it must be a question of the physiological and not the morphological conditions which we will have to investigate. Even though it might seem but a wild stretch of the imagination to even think of realizing such possibilities, it is plain that along the line of these and of related questions much information of the highest importance will probably be obtained.

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Zur Psychologie des Lesens bei Kindern und Erwachsenen. OSKAR MESSMER. Archiv für die gesammte Psychologie, December, 1903, Band II., Heft 2 u. 3. Pp. 190–298.

Experimentelle und kritische Beiträge zur Psychologie des Lesens bei Kurzen Expositionzeiten. ERICK BECKER. *Zeitschrift für Psychologie und Physiologie der Sinnesorgane.* Band 36, Heft 1 u. 2. Pp. 19–73.

These articles are concerned with the problems of word-perception. Becker discusses critically the earlier tachistoscopic investigations of Wundt and Zeitler and of Erdmann and Dodge, and offers experimental evidence of the correctness of the methods and conclusions of the latter that the perception of words is by means primarily of the total word-form. Messmer develops the main theories of Wundt and Zeitler of a successive apperception (in the Wundtian sense of the word) of the single elements of the word complex by means of a rapid movement or fluctuation of attention over it, and a second hypothesis of Zeitler closely connected with this, that of the so-called domineering letters.

On the basis of experiments with very short exposures of words with four adult subjects and six children of seven to eleven years of age, Messmer attempts a classification of readers into two general types, the objective and the subjective type.

In the case of the former the point of attention coincides very closely with the physiological fixation point. Long words are read only by combining single sections of small groups of letters which are successively perceived. The perception of the subjective type is, in contrast, relatively independent of the exact place of fixation. During the brief interval of exposure the attention flits back and forth within the field of view; and is thus able to fix upon long words and phrases in their entirety. If a word is placed well to the left of the point of fixation, the objective type of reader can see only the few letters lying nearest to the fixation; the subjective type, by means of this ready movement of attention, grasps

the whole word. The former depends further in perception almost exclusively on the exterior stimulus, the latter is interpretative and liable to mistakes and confusion.

The number of cases is small. The results of the readings of but one adult in each case illustrate the classification with any consistency. Children are believed, however, to exhibit as a class a wide fluctuation of attention. Experiments were not made to determine when in that case the transition to the objective type takes place. That subjects offer introspective evidence of this wandering of attention in the almost imperceptible interval of two sigma must, it seems to the reviewer, raise a presumption against the accuracy of the introspection.

The author's conception of word-perception combines with some vagueness the theories of immediate apprehension by means of the word form, and of successive perception on the basis of differences in the relative optical distinctness of letters, and letter groups. The more letters there are of individual geometrical form in a word, the greater is the danger of the word innervation being divided; and, contrariwise, the fewer the differentiating letters, the greater is the aid given to a single unitary innervation. The domineering letters being more easily seen are first recognized. This necessitates a back and forward movement of attention, and thus differs importantly from the left to right succession supposed by Zeitler.

In the ordinary method of reading, sentences composed mainly of short words are more difficult to read and take more time than those of long words, the motor innervation tending to fewer interruptions in the latter case. Fatigue occurs more noticeably in very rapid reading. Children read nonsense syllables as rapidly as words; adults read the former relatively much more slowly. Valuable lists and discussions of the number and kind of mistakes made by children and adults in tachistoscopic reading are collected at the end of the paper.

Becker's article is first concerned with the ealier criticisms of method, namely the partial adaptation of the eye during exposure, the presence of after-images, and the length of time for exposure admitting the possibility of changes of attention during the interval. The question of adaptation may be disposed of with the observation that as many words are actually read as is possible by the usual fall exposure apparatus, where such adaptation is not supposed to be present. The presence of after-images caused by exposures of only a fraction of a second and not differing noticeably in intensity from the surrounding light could at most aid only in acquiring the rough general appearance of the word form and not in detection of the individual letters; and there was, finally, no evidence of their presence in the experiments as conducted.

The probability of a shifting of the attention during the time of exposure is the main subject of investigation. The chief effect of such changes would be to increase the amount of matter read at one time—the main objection of the earlier criticism. Becker's experiments show, however, that as many letters—up to twenty-six—can be read in the extremely short interval of spark illumination during which time the pos-

sibility of change of attention has not been thought possible. The danger of after-image effects was carefully excluded. The hypothesis is further criticized on theoretical as well as on experimental grounds. The general theory advocated by Wundt was that the unequally favorable position of the different parts of the field of view during fixation is rendered less noticeable through the fact that the point of attention moves successively to those letters which are distant from the point of fixation; a 'searching' (*absuchen*), as it were, of the visual field thus occurs at each fixation. Such an hypothesis seems improbable in view of the difficulty which is ordinarily experienced in separating the points of attention and fixation; and the experiments made tend to disprove it.

In the first experiment the attention and fixation are centered together upon a letter lying in the primary line of regard; in the second experiment the attention is separated from the point fixated to a letter lying to the left of it. If a frequent change of attention occurs during the exposure, both letters ought to be equally well perceived in either instance. The results show, however, that in the first case the letters to the left are less often read, and in the second case the percentage of perception of the left letter is twice as great as in the first experiment. One fact may have escaped the writer and at least needs explanation, viz., that the total number of perceptions of *both* letters is larger when the attention is separated from fixation than when they are directed together. It suggests, especially in view of the difficulty which the subjects experienced in maintaining the separation of fixation and attention, the possibility of small eye movements and inaccuracy of fixation, so that the actual points of fixation and attention may have each lain somewhat within the space between the two letters. The only means at the writer's disposal of guarding against this contingency was direct observation of the subject's eyes.

In another experiment red circles were placed about some of the letters, the theory of course being that, if a shifting of the attention occurred, it would center reflexly on these letters. The results were again negative, the color seeming to have somewhat of a disturbing effect. The further observation of the author that the non-domineering letters, such as in the endings *en, es* and *er* of words and elsewhere, are sometimes as clearly recognized in the shortest exposures leads to the conclusion that the importance of the domineering letters is simply in the more effective conditioning of the gross word form of which these more prominent letters are capable.

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Cournot et les principes du calcul infinitesimal. HENRI POINCARÉ. *Revue de Metaphysique et de Morale,* May, 1905, pp. 293–306.

This article by Poincaré is one of twelve by as many writers in the present number of the *Revue,* all of which are devoted to an examination of the ideas of A. A. Cournot (1801–1877). These have been strangely neglected, not only by thinkers who have come after him, but by the men

of his own time. Mentré, who deals admirably with 'Les racines historique du probabilisme rationnel de Cournot,' explains the silence of Cournot's contemporaries regarding his work as due to his modesty and the slightness of his skill in advertisement, to the circumstances (events of 1848 and 1870) that attended the publication of his works, to the then tyrannical reign of eclecticism, to the exclusively literary culture of his generation, and finally to the common fortune of all misunderstood geniuses, that of being in advance of the thought of their time. Cournot's was a polydynamic mind. His scientific and philosophic interests are strikingly diverse and manifold. History, education, politics, criticism, economics, methodology, statistics, logic, social science, mathematics, all came well within the range of his intellectual activity.

In the article under review Poincaré presents Cournot's mathematical thought in so far as it bears especially upon the character and significance of the calculus. Naturally, in this connection, the focal points and defining lines of the elder savant's philosophy come clearly into view. The so-called two methods of the calculus, that of limits and that of infinitesimals (*infiniment petits*), the Leibnitzian and the Newtonian, which the modern mathematician is disposed to regard as only a difference of notation, seemed to the critics of Cournot's time to differ profoundly. To Cournot himself the two methods appeared to be not merely distinct, but opposite. Each was the exact inverse of the other. How and why? The answer is found in his scheme of thought, in his philosophical tenets, and is near at hand. Cournot was a thoroughgoing realist. There was an external universe quite independent of any thinker. Kant was wrong in regarding space and time as 'merely conditions upon the understanding, as forms inherent in the constitution of the human mind and not in the exterior things which it perceives.' Space and time, however, and other magnitudes are continuous. Natural changes, as growths, expansions, contractions, velocities, accelerations, are continuous. These proceed infinitesimally. The *natural* order is *from* the *infinitesimal* (*infiniment petit*) *to* the *finite*. This *natural* order is also (for Cournot) the *rational* as *opposed* to the *logical*, which latter, unlike the former, depends upon the thinker. The thinker is man, who, because of his infirmity, can not proceed *rationally* but only *logically, i. e., from* the *finite to* the *infiniment petit*. Accordingly the method of limits is logical, but not rational, while that of infinitesimals is rational, but not logical. Both, however, are available for dealing with continuities. Both are rigorous, the former directly, the latter indirectly, *through* the former. And in this connection, it is a fine conceit of Cournot's that, because the natural or rational order is from the infinitesimal to the finite, the derivative $f'(x)$, contrary to Lagrange's usage, should be called the generating or *primitive* function and $f(x)$ the derivative or *derived*. A word of elaboration may be permitted here. Suppose, for example, that $f(x) = \frac{4}{3}\pi x^3$, the volume of a sphere of variable radius x; then $f'(x) = 4\pi x^2$, which is precisely the surface, the *front* (as Professor W. B. Smith has happily called it) *of variation* of the varying volume. If, again, $f(x) = \pi x^2$, the area of an expanding or contracting circle, then $f'(x) = 2\pi x$,

which is the circumference, *i. e.*, again the front of variation, the *primitive* variable which by continuous change generates the areal magnitude $f(x)$. The latter is, accordingly, in the sense explained, in conformity with natural (Cournot's rational) process, strictly the derivative of $f'(x)$.

The distinction or opposition between the *rational* and the *logical* is for Cournot, despite their etymological equivalence, fundamental and very significant. Rational order holds of things considered in themselves independently of thoughts or thinkers. Logical order is merely a property of language regarded as instrument of thought. The former consists in, resides in, first principles, simplicities, which are quite independent of their discovery and out of which the complex directly arises. The latter proceeds in the inverse order, by a kind of *reductio ad absurdum,* indirectly from the complex and secondary to the simple and primary. *Raison* is, then, something absolute and would be the same for thinkers of different psychological constitution from that of man. *Cause,* on the other hand, is relative, has a 'double origin, physical and psychological.' Consequently all truths, all verities, be they mathematical theorems or physical phenomena, have their *reason,* but only phenomena have their *cause.*

For Cournot, then, nature is rational and simple. The simple is the reason of the complex. The single Newtonian law is the reason of the Keplerian triplet or complex of laws. In proportion as a formula becomes complicate, *ceteris paribus,* it becomes suspicious. Simplicity and symmetry being thus for Cournot the criterion of certitude, he finds in them 'the secret of the preeminent rôle of mathematics. Mathematics is the science *par excellence,* the most perfect example of scientific form and construction.'

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JOURNALS AND NEW BOOKS

ARCHIV FÜR GESCHICHTE DER PHILOSOPHIE, April, 1905, Band XI., Heft 3. *Paul Tannery, historien der philosophie* (pp. 293–302): F. PICAVET. – His life and works, with special attention to his division of the development of Greek science into four epochs. *Einteilung der griechischen Philosophie* (pp. 303–314): GOEDECKEMEYER. – In the ontological stage we see the divisions of the naïve period and that of the Sophists and methodical philosophers. In the 'eudæmonistic' stage those of Pyrrhonic scepticism with Epicurus and the Stoa, of Carneadean scepticism, with the philosophy of compromise, and of Ænesidemean scepticism with the philosophy of revelation and of positivism. *Zur Geschichte des Briefwechsels zwischen Leibnitz und Malebranche* (pp. 315–321): A BUCHENAU. – A letter from Leibnitz, hitherto omitted from the printed publications of this correspondence, is here given, with comments. *Voltaire als Philosoph* (*Schluss*) (pp. 322–368): P. SAKMANN. – Voltaire would limit the power rather than the goodness of God. In opposing

Christianity he held that the conception of God as punitive and rewarding is useful and pedagogical rather than true, and it must be freed from all that is anthropomorphic, as well as from all that is immoral, with a view to eliminating also the moral and providential attributes religion ascribes to him. The soul is a function of matter, and not substance; but matter could not create soul, which God himself created. In later life he inclined from the belief in man's freedom to disobey God to the conception of absolute determinism by God's laws. *Die geschichtlichen Grundlagen der Weltanschauung Schopenhauers* (pp. 369–394): P. WAPLER. – Schopenhauer was indebted to Tieck's pantheism, to Schelling's monistic striving, and to Voltaire's free thinking and cynical vein. He learnt from Plato and Boehme rather than from Spinoza. (Schluss folgt.) *La psycho-physiologie des passions dans la philosophie ancienne* (pp. 395–413): G. L. DUPRAT. – With Plato the leading conceptions in this connection were conformity to nature and repletion, pleasure requiring both of these, pain the absence of either. Aristotle's explanation of emotion through the medium of the πνεῦμα, intermediate between fire and air, dominated his successors (under the form of 'animal spirits') even to modern times. *La beatitude chez Spinoza et chez Fichte* (pp. 413–422): O. BOS. – While both find blessedness in true thinking, Spinoza alone admits that revelation of itself can give blessedness to the believer. Spinoza clings to the personal immortality of the soul, and to the emanation theory of the Neo-platonists, both of which Fichte rejects. *Jahresbericht; III., Die polnische Philosophie der letzten zehn Jahre* (1894–1904) (pp. 423–436): H. v. STRUVE. *Die neuesten Erscheinungen. Eingegangene Bücher. Zeitschriften.*

ANNALEN DER NATURPHILOSOPHIE, April, 1905, Band IV., Heft 2. *Über die Erziehung der Chemiker* (pp. 153–170): W. RAMSAY. – Discoverers are made rather than born, and should be the goal of all instruction in chemistry. To this end let all, young and old students and professors work together in the laboratory; which should be small. Let the students learn through failures. The highest positions should be very well paid, and should be filled by the vote of the related faculties. Examinations stifle the spirit of invention. *Das biologische Moment in alten Pflanzendarstellungen* (pp. 171–188): F. ROSEN. – From the fourteenth to the sixteenth century the most noted works of art exhibit scant information concerning biological facts, though an improvement is to be noticed toward the end of the period. *Zur neueren Entwicklung der Biologie* (pp. 188–203): J. LOEB. – Biologists may now reciprocate chemical aid by producing through enzymes important chemical compounds. Mendel and de Vries introduced a new art, that of artificial evolution. We may be on the eve of most important discoveries as to the function of tropisms in instinct, and of the fatty connection of nerve cells in the work of thought associations. Psychology must vary more the organisms which are its objects of study. Technical biology is the weightiest innovation of the century, by which microorganisms produce remedies for diseases, as well as food and other sources of energy practically available.

Science too is potent in displacing superstition, and in substituting an ethics of production for an ethics of spoliation. *M. W. Lomomossow, der erste russische Chemiker und Physiker, mit Bildnis* (pp. 204–225): B. N. MENSCHUTKIN. – A detailed account of his life and works. He was pre-eminent in introducing quantitative work in chemistry. *Eine energetische Darstellung des Brechungsquotienten* (pp. 226–232): W. GRIMM. *Über den Grundbegriff der Wirtschaftswissenschaft* (pp. 233–239): J. ZMAVC. – This fundamental concept is that of human work. *Über die Grösse der unmittelbaren Berührung zweier Punkte. Beitrag zur Begründung der diskreten Geometrie* (pp. 239–269): B. PETRONIEVICS. *Neue Bücher* (pp. 269–280): 'W. O.' – H. Driesch, *Die Seele als elementarer Naturfactor.* H. Driesch, *Naturbegriffe und Natururteile.* W. Jerusalem, *Einleitung in die Philosophie.* W. Jerusalem, *Lehrbuch der Psychologie.* A. Petrunkewitsch, *Gedanken über Vererbung.* Yrjö Hirn, *Der Ursprung der Kunst.* W. Schultz, *Das Farbenempfindungssystem der Hellenen.* A. Pfänder, *Einführung in die Psychologie.* J. Petzold, *Sonderschulen für hervorragend Befähigte.*

Duncan, R. K. *The New Knowledge.* A popular account of the new physics and the new chemistry in their relation to the new theory of Matter. New York: A. S. Barnes & Co., 1905. 8vo. xviii + 236 pp. $2.00 net.

Ostwald, W. *Kunst und Wissenschaft. Vortrag.* Leipzig: Veit & Co. 1905. 8vo. 1 M.

Revel. *Les mystiques devant la science; un essai sur le mysticisme universel.* Paris: Bodin. 1905. 8vo. 159 pp.

Riehl, A. *Zur Einführung in die Philosophie der Gegenwart. 2., durchgesehene Auflage.* Leipzig: B. Y. Teubner. 1905. 8vo. Pp. vi + 274. 3 M.

Ritchie, D. G. *Philosophical Studies.* London: Macmillan. 1905. 8vo. 10s.

Sidgwick, H. *Lectures in the Philosophy of Kant.* London: Macmillan Co. 1905. 10s.

Spranger, E. *Die Grundlagen der Geschichtswissenschaft.* Berlin: Reuther & Reichard. 1905. 8vo. 3 M.

Sterrett, J. M. *The Freedom of Authority.* New York: The Macmillan Co. 1905. 8vo. vi + 319 pp. $2.00 net.

Stohr, A. *Leitfaden der Logik in psychologistierender Darstellung.* Wien: Deuiticke. 1905. 8vo. 4 M.

The Philosophical Works of Francis Bacon. Reprinted from the Texts and Translations of Ellis and Spedding; edited by John M. Robertson. London: Routledge. 1905. 5s.

NOTES AND NEWS

PROFESSOR FERRARI contributes to the April number of the *American Journal of Psychology* a note on 'Experimental Psychology in Italy.' The beginnings of experimental psychology in Italy have been, he states, very precocious and very important. Buccola was, without doubt, the first to make use of lunatics in the study of problems arising in normal psychology. Since the death of Buccola, the Psychiatric Institute of Reggio Emilia has maintained the tradition of experimental psychology, and there, in 1896, was established the first laboratory of experimental psychology, properly so-called, in Italy, although Professor Sergi had already a laboratory of anthropology and psychology at Rome. The Psychiatric Institute of Reggio Emilia publishes the *Revista Sperimentale di Freniatria*, in which most of the psychological contributions of Italian workers have appeared. Recently two chairs of experimental psychology have been founded, one at the University of Rome, occupied by Professor De Sanctis, the other at the University of Naples, occupied by Professor Colucci. Pofessor Ferrari notes the great stimulus given to the study of psychology in Italy by his translation, in 1901, of the 'Principles of Psychology' of Professor James. That the first edition of over 2,000 copies should have been exhausted in two years has 'for a country on the road to fortune, but still very poor—something marvelous about it.'

DR. HENRY H. DONALDSON, since 1892 professor of neurology at the University of Chicago, has been elected professor of neurology at the Wistar Institute of Anatomy, Philadelphia, having been selected for this position by the advisory board of the institute, consisting of leading American anatomists. Dr. Donaldson will assume his new duties at the institute on October 1, 1905, and will be at the institute during January, February and March. This arrangement will continue for two years, when Dr. Donaldson will be permanently transferred to the institute. Every effort will be put forth to establish a strong corps of neurological workers, as neurology will be the field to which the institute will devote its first attention. An assistant to Dr. Donaldson will be selected by the advisory board.

MR. DAVID F. SWENSON, instructor in philosophy in the University of Minnesota, has been granted a year's leave of absence. He will spend this year at Columbia University as assistant in philosophy. His place at Minnesota will be filled by Dr. Percy Hughes, for the past two years assistant in philosophy at Columbia University.

DR. WALTER F. DEARBORN (Columbia) has been appointed instructor in educational psychology at the University of Wisconsin.

DR. WENDELL T. BUSH (Columbia) has been appointed lecturer in philosophy at Columbia University.